

LONDON- WEST MIDLANDS ENVIRONMENTAL STATEMENT

Volume 5 | Technical Appendices

CFA4 | Kilburn (Brent) to Old Oak Common

Water resources assessment (WR-002-004)

Water resources

November 2013

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Department
for Transport

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1 Introduction

1.1 Structure of the water resources and flood risk assessment appendices

- 1.1.1 The water resources and flood risk assessment appendices comprise three parts. The first of these is a route-wide appendix (Volume 5: Appendix WR-001-000).
- 1.1.2 Specific appendices for each community forum area (CFA) are also provided. For the Kilburn (Brent) to Old Oak Common area (CFA₄), these are:
- a water resources assessment (i.e. this appendix);
 - a flood risk assessment (Appendix WR-003-004); and
 - a hydraulic modelling report of a breach of the Grand Union Canal (GUC) (Paddington Branch) at Old Oak Common (Appendix WR-004-001).
- 1.1.3 Maps referred to throughout the water resources and flood risk assessment appendices are contained in the Volume 5, Water Resources and Flood Risk Assessment Map Book.

1.2 Study area

- 1.2.1 The study area extends from Kilburn High Road in the east to Park Royal Road in the west. It lies partly within each of the London Borough of Brent (LBB), the Royal Borough of Kensington and Chelsea (RBKC), the City of Westminster (CoW), the London Borough of Hammersmith and Fulham (LBHF) and the London Borough of Ealing (LBE). The adjacent CFA are Primrose Hill to Kilburn (Camden) (CFA₃), to the east and the Northolt Corridor (CFA₅) to the west.
- 1.2.2 The Proposed Scheme through this area will be approximately 5.4 km in length and will commence at Kilburn High Road. The route will be constructed entirely in tunnel and will proceed south-west to include a new ventilation and intervention shaft (vent shaft) at Salusbury Road in Queen's Park, before continuing west for a further 2.6km into a triangular site at Old Oak Common. The triangular site will be bordered by Old Oak Common Lane and Wells House Road to the west, the Great Western Main Line tracks and North Pole depot to the south and the proposed Crossrail depot to the north. Within the triangular site a new interchange station, known as Old Oak Common station and associated infrastructure, will be constructed.
- 1.2.3 The spatial scope of the assessment was based upon the identification of surface water and groundwater features within 1km of the centre line of the route, except where there is clearly no hydraulic connectivity. For surface water features in urban areas, the extent was reduced to 500m. Outside of these distances it is unlikely that direct impacts upon the water environment will be attributable to the Proposed Scheme. Where works extend more than 200m from the centre line, for example at stations and depots, professional judgement has been used in selecting the appropriate limit to the extension in spatial scope required. For the purposes of this assessment this spatial scope is defined as the study area.

- 1.2.4 The main environmental feature of relevance to the water resources assessment is the GUC (Uxbridge to Hanwell Locks, Slough Arm, Paddington Arm).
- 1.2.5 The key environmental issues relating to water resources include the potential risk to surface water quality due to widespread construction activity. This includes the transfer of construction and excavated materials over the GUC (Paddington Arm).

2 Stakeholder engagement

2.1.1 Discussions were held with the following stakeholders to inform the water resources assessment:

- the Environment Agency with regard to surface water and groundwater impacts;
- the Canal & River Trust (formerly British Waterways) with regard to the GUC (Paddington Arm); and
- Thames Water Utilities Ltd with regard to the capacity of the combined sewer system to accept drainage discharges.

3 Baseline data

3.1 General

- 3.1.1 The following section provides a current description of water resources including surface water and groundwater.
- 3.1.2 The only water body within the study area that has been assessed by the Environment Agency under the Water Framework Directive¹ (WFD) is the GUC (Paddington Arm). The catchment falls within the Thames River Basin District as defined under the WFD and is covered by the Thames River Basin Management Plan² (RBMP).

3.2 Surface water features

- 3.2.1 All surface water features within 500m of the route are presented in Table 1.
- 3.2.2 The current surface water baseline and water features with codes listed in Table 1 are shown in Maps WR-01-004 (Volume 5, Water Resources and Flood Risk Assessment Map Book). If the feature has a specific reference number then this is provided (e.g. a surface water crossing will be referenced as SWC-CFA4-01). If the feature has no specific reference its location on a specific map is provided (e.g. WR-01-004, D6) where D6 is a grid reference using the map specific grid.
- 3.2.3 The surface water features are based on the Environment Agency's Detailed River Network (DRN) with the addition of water bodies noted on the Ordnance Survey's (OS) 'OS VectorMapDistrict'.

¹ Water Framework Directive, Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy, Strasbourg, European Parliament and European Council

² Environment Agency (2009) *River Basin Management Plan, Thames River Basin District*.

Table 1: Surface water features within 500m of the route in the study area

Water feature	Location description (Volume 5, Water Resources and Flood Risk Map Book map reference)	Watercourse classification ³	WFD water body and current overall status	WFD status objective (by 2027 as in RBMP)	Receptor value ⁴	Q95 ⁵ (m³/s)	Catchment area at crossing (km²)	Notes
GUC (Paddington Arm)	Will be crossed by the route near St Mary's Catholic Cemetery, College Park, (SWC-CFA4-01)	Artificial	GUC (Uxbridge to Hanwell Locks, Slough Arm, Paddington Arm). (GB70610078) Moderate	Good potential	High	Not applicable	Not applicable	GUC (Paddington Arm) is an artificial water body which passes under a number of bridges within the study area. The canal will be largely parallel to the route for approximately 1.4km. The route will cross below the canal in tunnel near St Mary's Cemetery, College Park.
Unnamed drain	Near Plough Close, College Park and north of the cutting containing the main railway to Euston.	Ordinary watercourse	Not assessed by the Environment Agency	Not assessed by the Environment Agency	Low	Not applicable	Not applicable	
Unnamed drain	Near John Perryn Primary School, Long Drive, East Acton.	Ordinary watercourse	Not assessed by the Environment Agency	Not assessed by the Environment Agency	Low	Not applicable	Not applicable	

³ Water-feature classifications: Section 113 of the Water Resources Act 1991 defines a main river as a watercourse that is shown as such on a main river map. Section 72 of the Land Drainage Act 1991 defines an ordinary watercourse as 'a watercourse that is not part of a main river'. Section 221 of the Water Resources Act 1991 defines a watercourse as including 'all rivers and streams, ditches, drains, cuts, culverts, dikes, sluices, sewers (other than public sewers) and passages through which water flows'. Main rivers are larger rivers and streams designated by Defra on the main river map and are regulated by the Environment Agency

⁴ For examples of receptor value, see Table 43 in the Scope and Methodology Report (SMR) Addendum, Volume 5: Appendix CT-001-000/2.

⁵ Derived from National River Flow Archive (NRFA) data and catchment areas calculated using the Flood Estimation Handbook (FEH) - Centre for Ecology and Hydrology, (2009) *Flood Estimation Handbook (FEH)* CD-Rom Version 3.0. Q95 is the flow which is exceeded for 95% of the time (i.e. it is a low flow and the river will only have flows less than this for 5% of the time).

3.2.4 There are no licenced surface water abstractions within this study area⁶. There is the potential for unlicensed abstractions to be present as a licence is not required for abstraction volumes below 20m³ per day; however none have been identified within the study area.

3.2.5 The Environment Agency reports that there are no active surface water discharge consents within 500m of the route.

3.3 Groundwater

3.3.1 The Langley Silt Member outcrops approximately 800m to the south of the route. Geological mapping indicates that no other superficial deposits are present within 1km of the route.

3.3.2 Map WR-02-004 (Volume 5, Water Resources and Flood Risk Assessment Map Book) illustrates the spatial distribution of the uppermost superficial and bedrock formations within the study area. A schematic cross-section of the study area with regard to geological strata, groundwater elevations (where known) and the Proposed Scheme is presented in Figure 1.

3.3.3 The London Clay Formation underlies the whole study area. The geological succession beneath the London Clay Formation comprises, in turn:

- the Harwich Formation;
- the Lambeth Group (also termed the Woolwich and Reading Formations);
- the Thanet Sand Formation; and
- the White Chalk Subgroup.

3.3.4 Figure 2 presents the groundwater elevation contours in the Chalk aquifer for this study area and adjacent areas using data from January 2012⁷. Groundwater flow in the study area is towards the south-east as shown by the groundwater elevation contours in Figure 2. It should be noted that the Chalk is confined so the apparent water level shown in Figure 2 is a representation of the water level that would be observed if the Chalk was penetrated by a borehole. It is not indicative of groundwater being present in the London Clay Formation.

⁶ Surface water abstractions for public supply are not included.

⁷ Environment Agency (2013), *Management of the London Basin Chalk Aquifer Status Report 2013*

Figure 1: Schematic geological and hydrogeological cross-section for CFA4

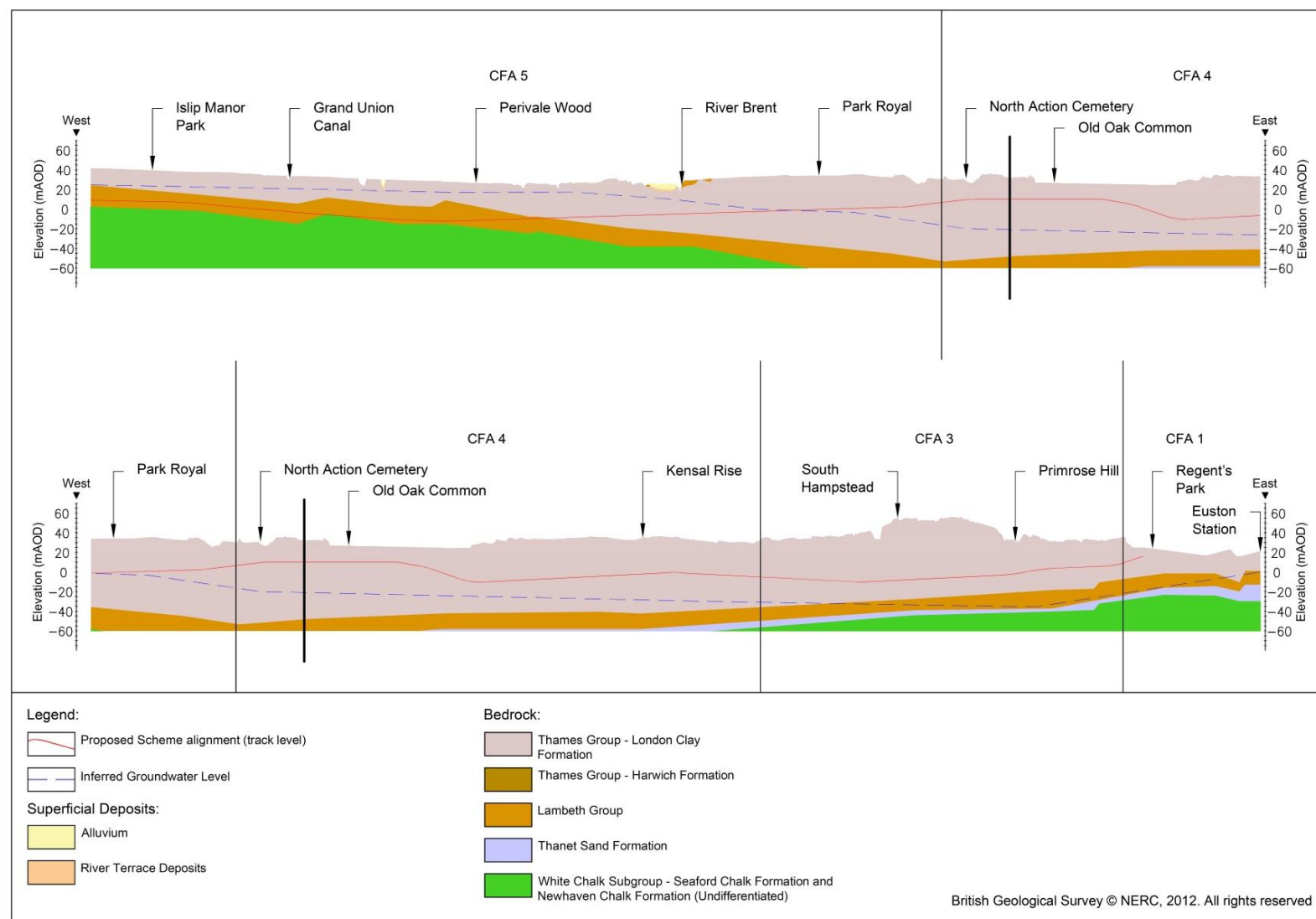
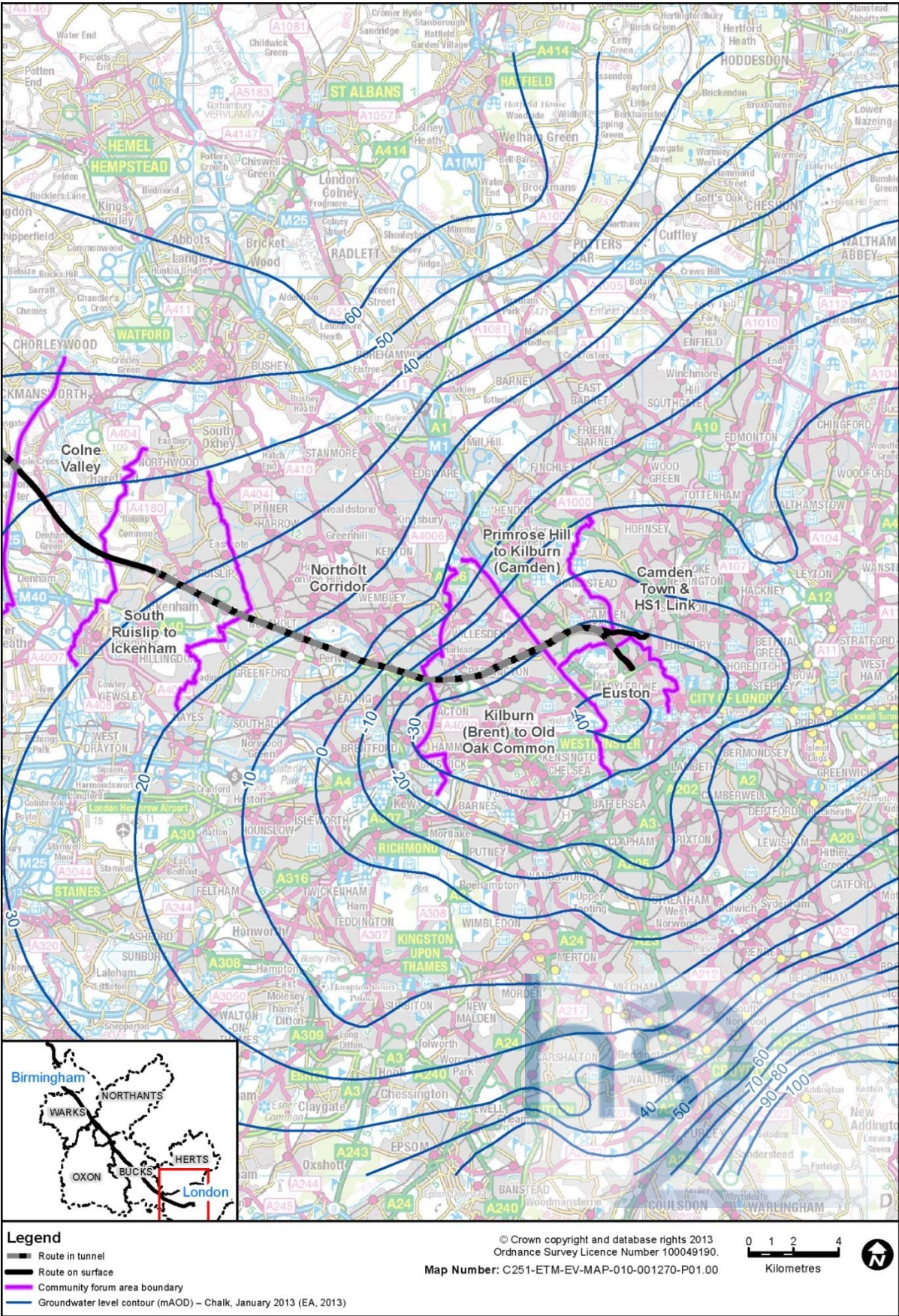


Figure 2: Groundwater elevation contours for this study area and the surrounding area



3.3.5 Table 2 summarises licensed groundwater abstractions within 1km of the route.

Table 2: Summary of groundwater abstractions

Licence identifier (map reference number and Environment Agency reference)	Distance and direction from route (m)	Abstraction horizon	Maximum annual abstraction quantity (m ³)	Maximum daily abstraction quantity (m ³ /d)	Purpose	Number of boreholes
TH/039/0039/033 (GW61)	980m south (200m south of nearest area of construction)	Chalk	240,451	950	Heat pump - commercial/ industrial/public services	1
28/39/39/0230 (GW59, GW58 and GW57)	1,200m south (470m south-west of nearest area of construction)	Chalk	29,280	80	Drinking, cooking, sanitary, washing, (small garden) - commercial/industrial/public services	3
	1,200m south (510m south-west of nearest area of construction)	Chalk	63,500	960	Non-evaporative cooling	
	1,200m south (640m south-west of nearest area of construction)	Chalk	Unknown	Unknown	Unknown	

3.3.6 No unlicensed groundwater abstractions have been identified in this study area. There is the potential for unlicensed abstractions to be present as a licence is not required for abstraction volumes below 20m³ per day; however none have been identified within the study area.

3.3.7 Table 3 summarises groundwater discharge consents within 1km of the route.

Table 3: Groundwater discharge consents

Reference number	Permit identifier	Distance (and direction) from route (m)	Discharge type	Receiving strata/ water body
CFA4-WD8	Eprgp3624ge	970m (south) 300m (south) from nearest area of construction	Miscellaneous discharges - mine/ groundwater as raised (education property)	Groundwater via a borehole.
CFA4WD9	Canm.1155	1,200m (south) 460m (south-west) from nearest area of construction	Trade discharges - cooling water	Groundwater via reinjection boreholes
CFA4WD6	Canm.1155	1,200m (south) 550m (south-west) from nearest area of construction	Trade discharges - cooling water	Groundwater via reinjection boreholes

3.4 Surface water/groundwater interaction and water dependent habitats

- 3.4.1 No surface water/groundwater interactions have been identified within 500m of the route in the area.
- 3.4.2 There are no known water dependant habitats within 1km of the route in this study area.

4 Site specific surface water assessment

4.1 Summary of assessment

- 4.1.1 Table 4 summarises all potential impacts and effects to surface water features from the Proposed Scheme in this study area. Only those impacts and effects that are classed as significant are presented in Volume 2, CFA Report 4, Section 13.
- 4.1.2 Table 4 only includes water features which could potentially be impacted by the Proposed Scheme. Features such as isolated ponds and drains which will lie outside the construction footprint and area of impact of the Proposed Scheme, are not included. Details of the features however, are provided in Table 1.
- 4.1.3 The draft Code of Construction Practice (CoCP), referred to in Table 4, sets out the measures and standards of work that will be applied to the construction of the Proposed Scheme (see Volume 5: Appendix CT-003-000/1). These will provide effective management and control of the impacts during the construction period.

Table 4: Summary of potential impacts to surface water

Surface water feature/ receptor	Receptor value	Design element	Discussion of potential impact to water receptor	Magnitude of potential impact and effect	Avoidance and mitigation measures included in design	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
GUC (Paddington Arm)	High	Euston tunnel HS1 - HS2 Link tunnel Old Oak Common station Old Oak Common tunnel Victoria Road crossover box Willesden Euroterminal railhead compound A temporary earthworks stockpile A temporary construction bridge over the canal Construction compounds	The tunnel will be constructed more than 10m beneath the canal and within the London Clay Formation and will not therefore impact on the GUC. Nearby construction activities could result in measureable surface water flow and quality effects (increased sediment load). See section 4.2.	Minor impact Moderate effect (Significant)	Monitoring during construction will be carried out as required by the Environment Agency Measures included in the draft CoCP will control sediment mobilisation and risk of spills.	Negligible impact Neutral effect (Not significant)	None	Negligible impact Neutral effect (Not significant)	Construction (temporary)
Unnamed drain near Plough Close, College Park	Low	Euston tunnel HS1 - HS2 Link tunnel	The drain is outside of the zone of predicted settlement associated with the construction of the Proposed Scheme so it will not be impacted.	None	None required	None	None	None	Not applicable
Unnamed drain, located near John Perryn Primary	Low	Great Western Main Line realignment	OS mapping indicates that the drain lies 10m south of the consolidated construction boundary.	Negligible impact	Requirement for monitoring during construction will	None	None	None	Construction (temporary)

Surface water feature/ receptor	Receptor value	Design element	Discussion of potential impact to water receptor	Magnitude of potential impact and effect	Avoidance and mitigation measures included in design	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
School, East Acton			There is the potential for the flow and water quality of the drain to be impacted during construction. Adherence to the draft CoCP is likely to prevent any temporary impact.	Neutral effect (Not significant)	be evaluated under the draft CoCP since the drain may extend northwards and connect to track drainage.				

4.2 Detailed assessments

Discharge of water during operation

- 4.2.1 The tunnel will be routed under the GUC (Paddington Arm) (Map WR-01-004, SWC-CFA4-01), which is the only WFD classified water body within the study area. There will not be any operational discharges into the canal from the Proposed Scheme. Therefore, there is no potential for the operation of the route to impact on this surface water receptor.
- 4.2.2 Drainage from Old Oak Common station and its approach roads and tunnel drainage will be pumped to the surface at Salusbury Road vent shaft and if necessary will then be discharged to the combined sewer system. Further consultation with Thames Water Utilities Ltd will be undertaken in the detailed design phase to ensure there are no unforeseen impacts on the sewer network.

Construction in the vicinity of watercourses

- 4.2.3 A number of construction elements will be located close to the GUC (Paddington Arm), both near the route and to the north of the route (near Willesden Junction and Wesley Playing Fields). These construction elements will include a temporary bridge over the GUC, office accommodation, storage facilities, construction rail head siding, temporary earthworks stockpile and a construction compound. These elements will have the potential to impact on the water flow and quality of the GUC which is a high value surface water feature with a current overall status of 'Moderate' under the WFD. The potential unmitigated impact is likely to be minor as it would be measurable but not impact on the WFD status. This would result in a slight effect (see Table 4).
- 4.2.4 Measures included in the draft CoCP to be implemented will include:
- a local assessment prior to construction;
 - measures to prevent the uncontrolled discharge of sediment and pollutants;
 - adherence to the Environment Agency's Prevention of Pollution Guidelines⁸; and
 - monitoring during construction.
- 4.2.5 The measures in the draft CoCP will minimise the impacts on the GUC and any remaining impacts are assessed as likely to be negligible.
- 4.2.6 Construction work associated with the existing main line route, from Old Oak Common and through East Acton, will be adjacent to the drain at John Perryn Primary School. The temporary works will have the potential to impact on the flow and water quality of the drain which is a low value surface water feature. Adherence to the CoCP including a local assessment of the flow paths prior to construction will ensure that temporary effects will be negligible.

⁸ Environment Agency, (2013) *Groundwater protection: Principals and practice (GP3)*. GP3 version 1.1, August 2013

5 Site specific groundwater assessment

5.1 Summary of assessment

- 5.1.1 The route will pass in tunnel through the London Clay Formation at an elevation above the expected piezometric surface in the underlying Chalk Group Principal aquifer (see Figure 1) and no potential impacts on groundwater resources have been identified
- 5.1.2 The Proposed Scheme will include plunge columns/tension piles under the Old Oak Common station box. These are also not expected to pass below the base of the London Clay Formation. Therefore there would be no impact on groundwater resources from these works.

6 References

Centre for Ecology and Hydrology. (2009) *Flood Estimation Handbook (FEH)* CD-Rom Version 3.0.

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Environment Agency (2009). *River Basin Management Plan, Thames River Basin District*.

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